

Cochlear Dead Regions: Assessment and Clinical Implications

Will it Change Patient Management?

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Outline

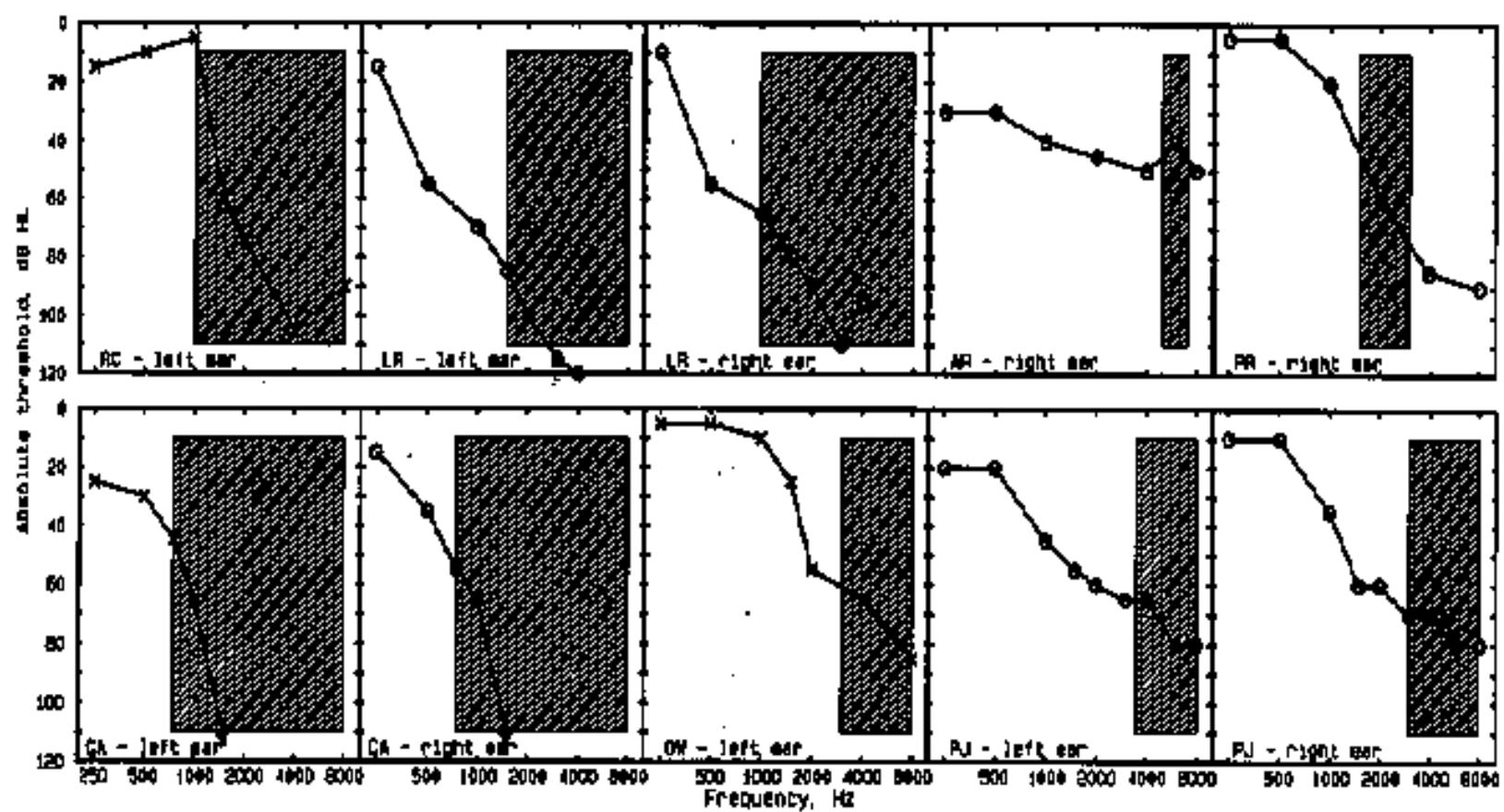
- Top-level View
- Using TEN Results Alone to identify “Dead Regions”
- Speech Results and AI Predictions
- Conclusions

Collaborators (aka the folks that did most of the work!)

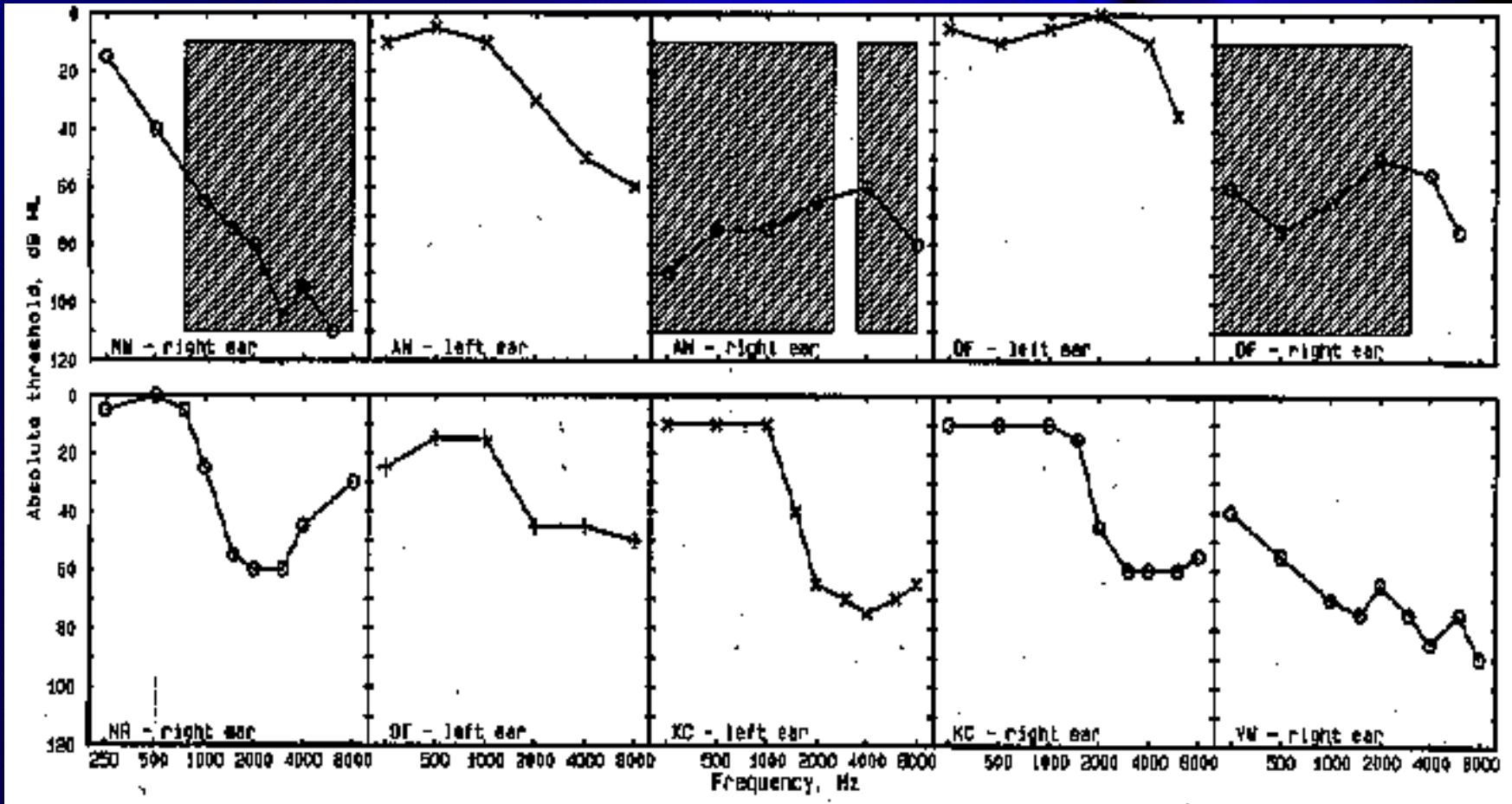
- Bill Woods
- Dianne Van Tasell
- Melanie Gregan
- Maria Ioannou
- Steve Lund
- Karrie Recker
- Martin Rickert (Indiana University)

The Superficial Perspective

The famous cartoons...

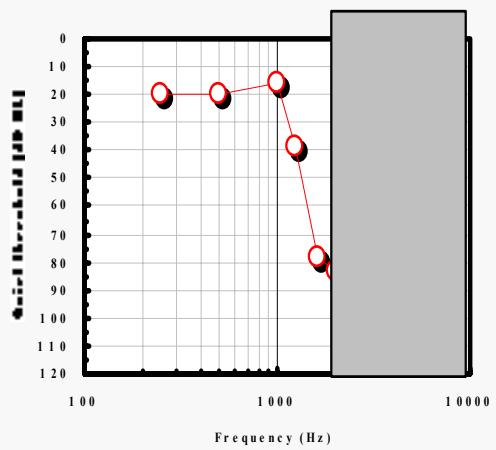


From Moore et al., 2000

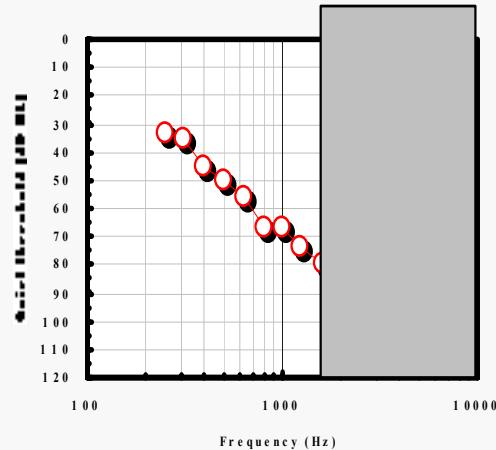


From Moore et al., 2000

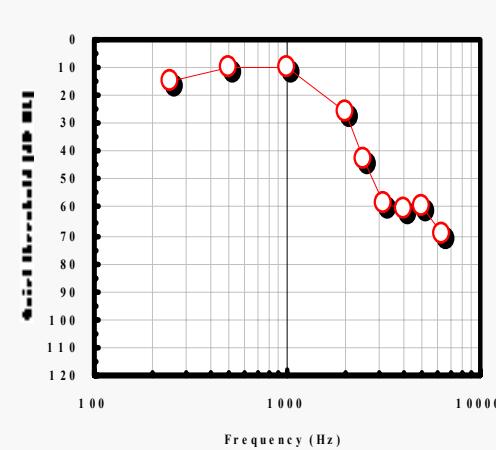
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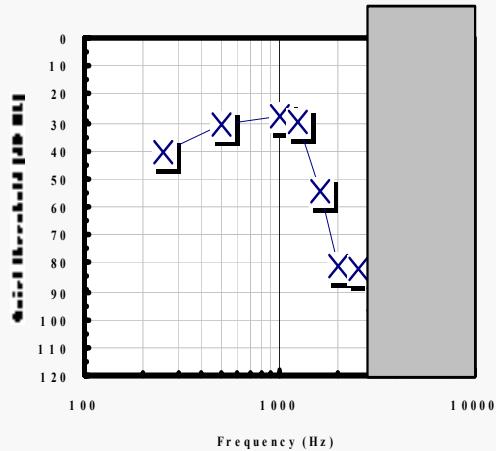
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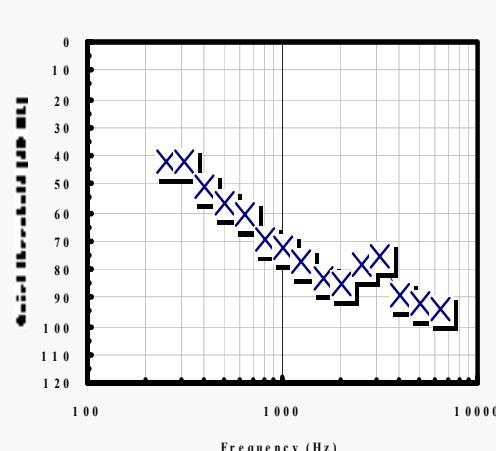
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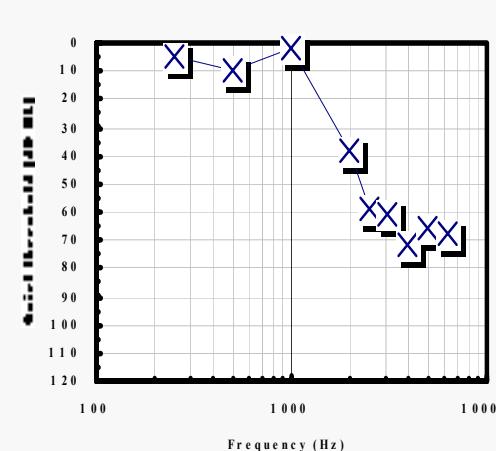
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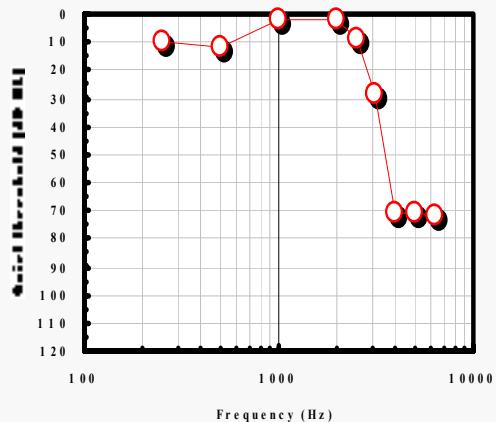
DA: L



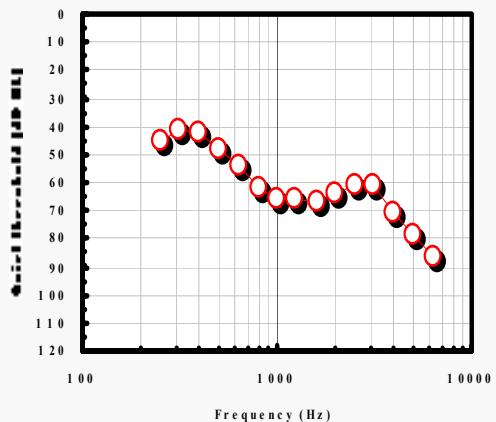
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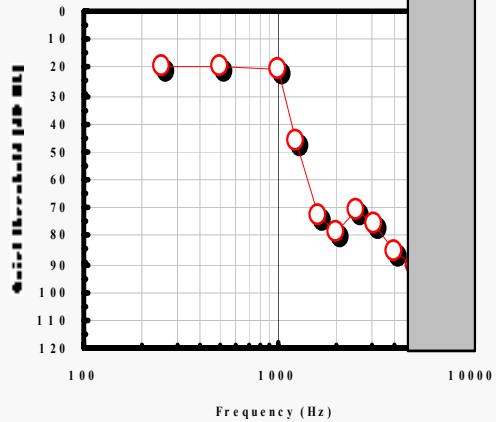
BF: R



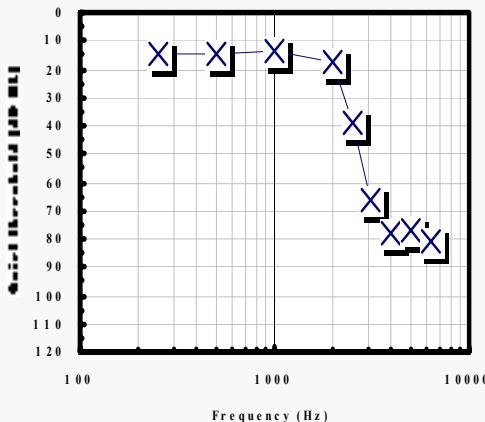
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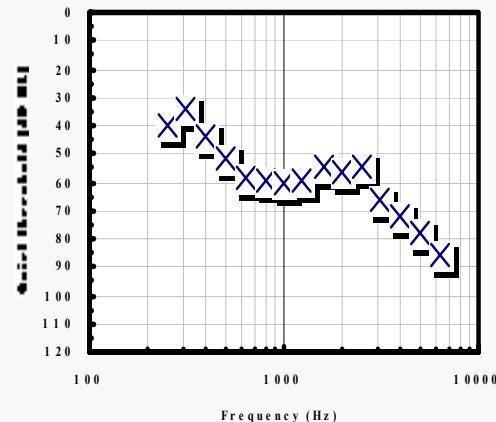
CJ: R



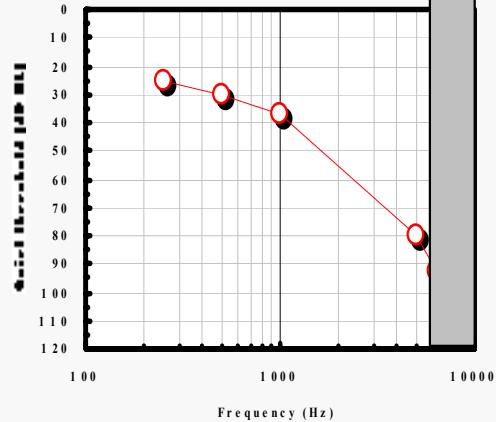
BF: L

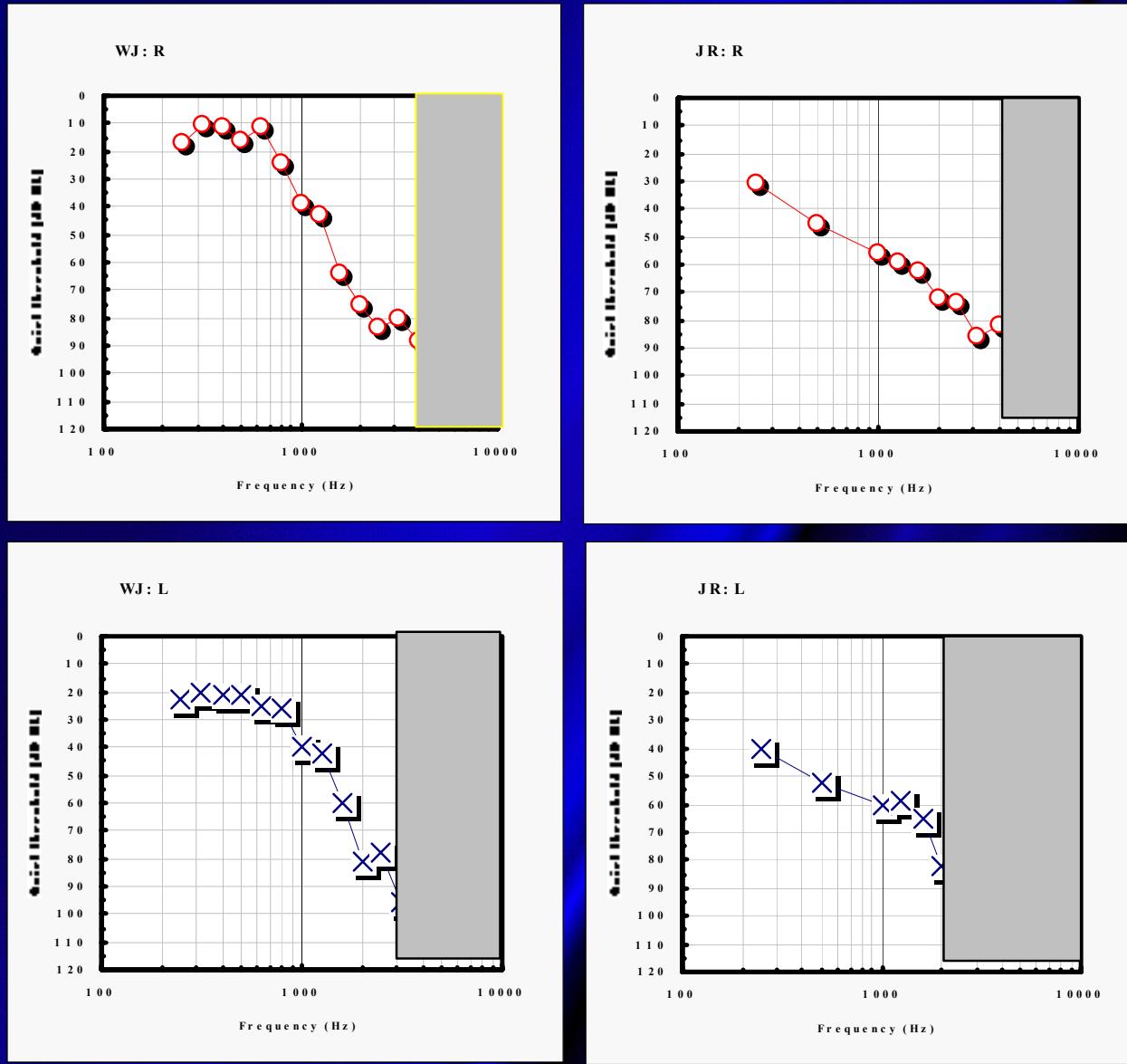


RW: L

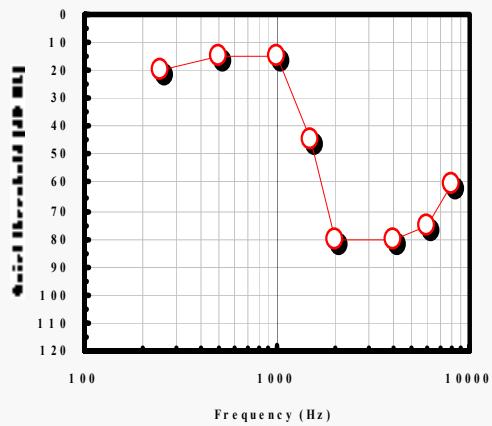


ES : R

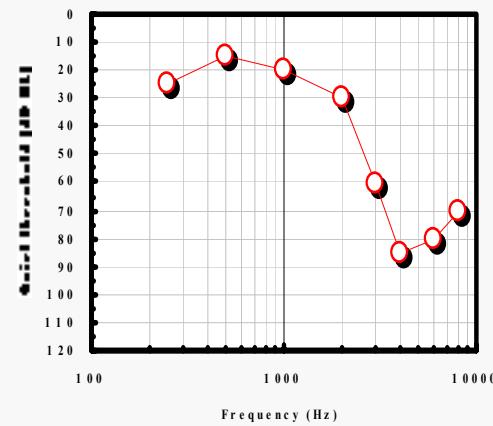




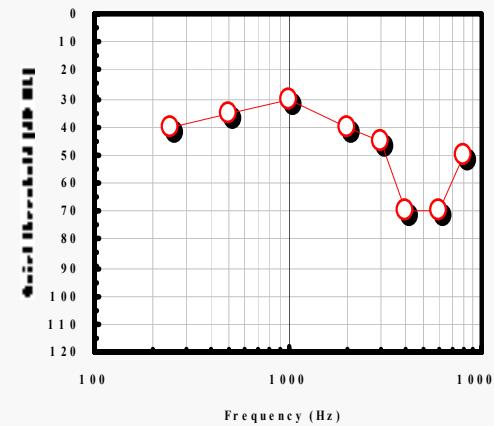
JB: R



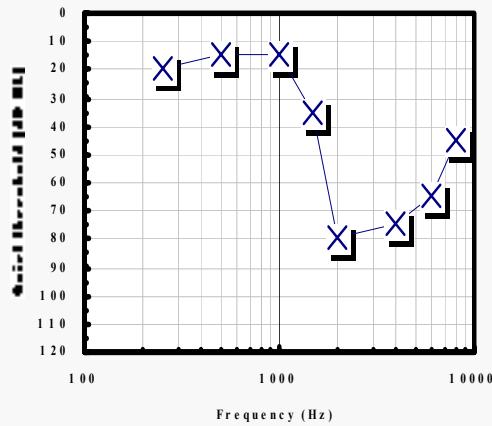
DM: R



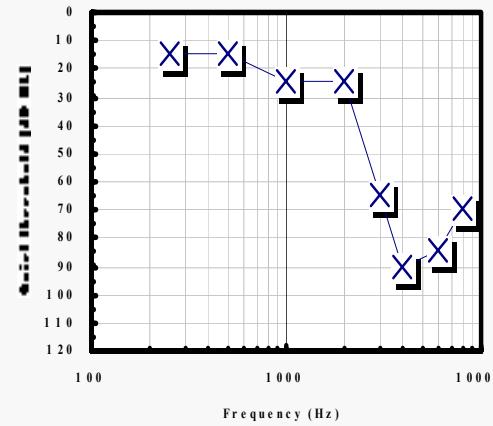
JC: R



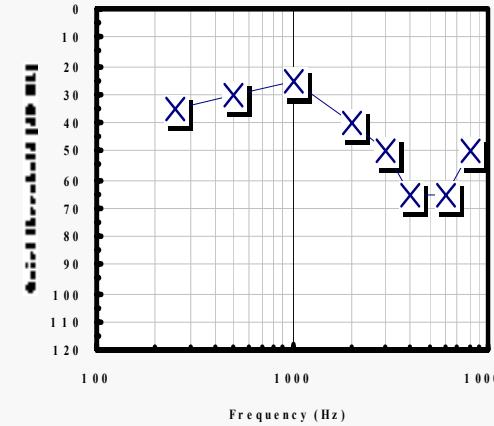
JB: L



DM: L



JC: L



Two Problems with this Summary

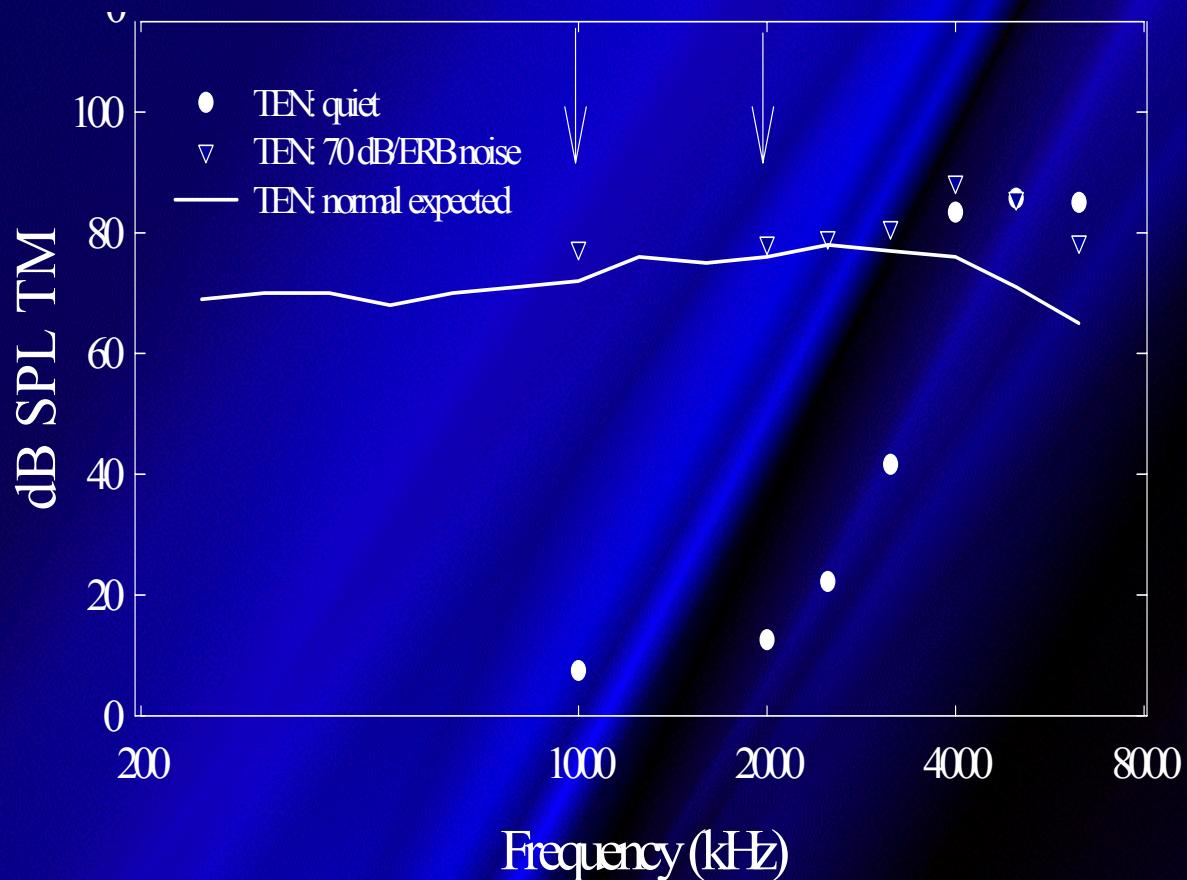
- One
 - The cartoon characterizations are not consistent with the details in the data.
 - Identifying a region based on elevated thresholds in TEN alone is ambiguous at best.
 - Moore et al. ultimately relied on the tuning curve data to decide on the edge of a dead region.
- Two
 - Identifying patients with “Dead Regions” using the CD is pretty hard!
 - Using the 10 dB criterion, we have never identified a “region” of elevated thresholds but only single frequencies.

Detailed View of TEN Results

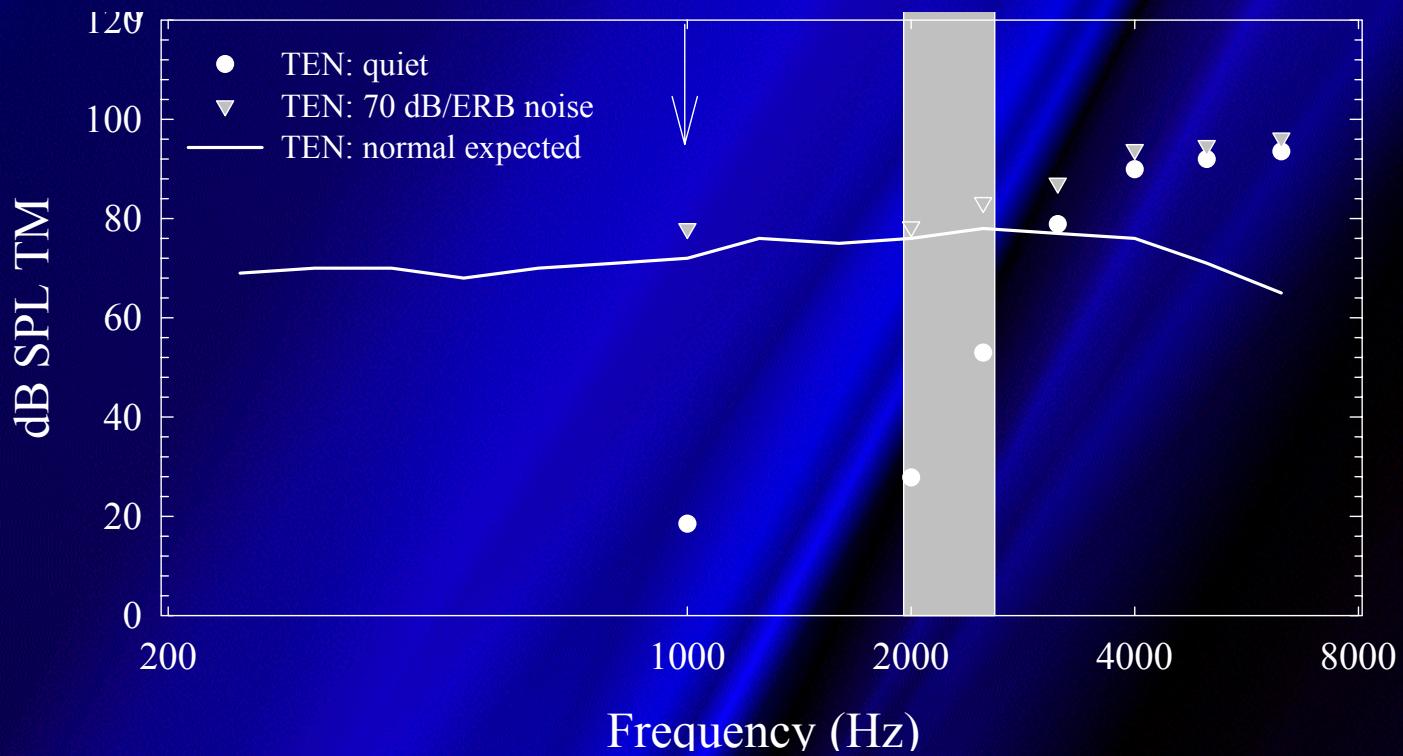
- Methods
 - Modified the testing approach to improve sensitivity
 - 3IFC
 - threshold based on last 10 of 14 reversal track, minimum of 3 tracks per threshold
 - Final step size = 2 dB
 - Shift criterion = 5 dB
 - Measured thresholds at 1/3 octave intervals in quiet and in TEN
 - 70 dB/ERB TEN

Subset of TEN Results

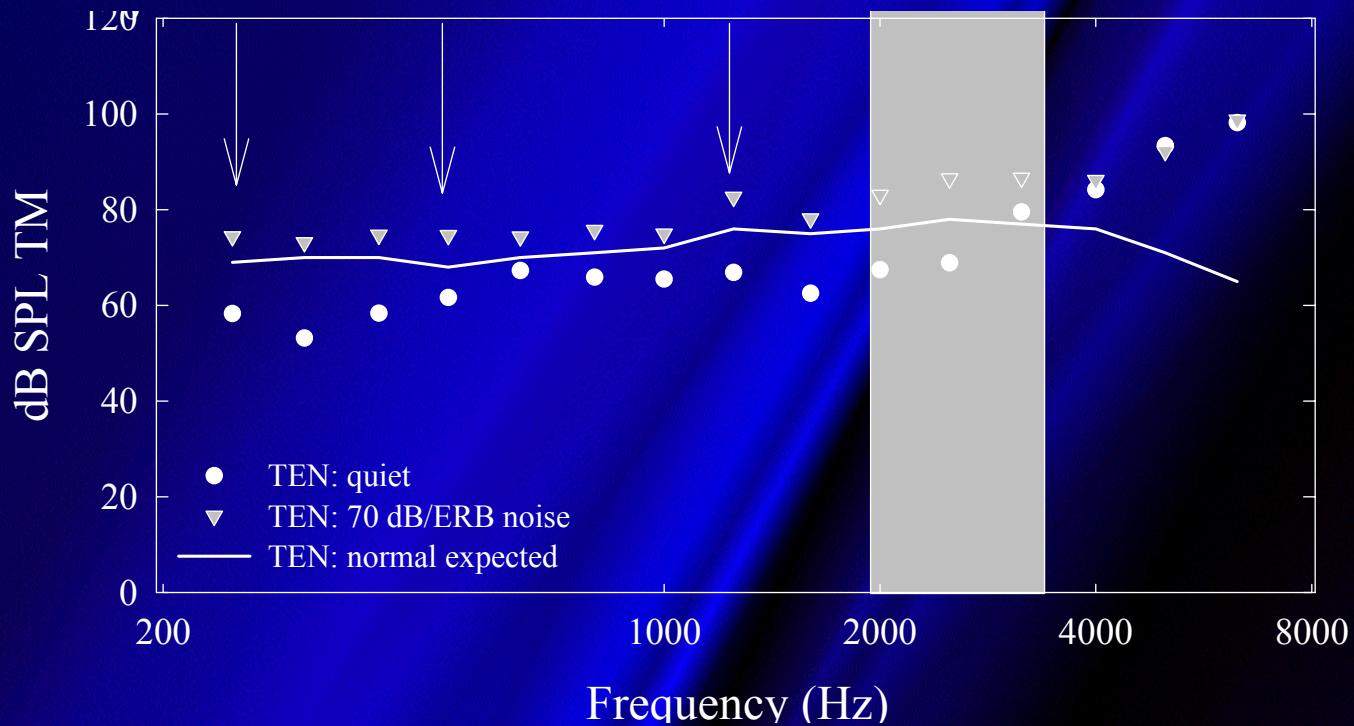
Arrows and shading indicate frequencies with significant threshold shifts



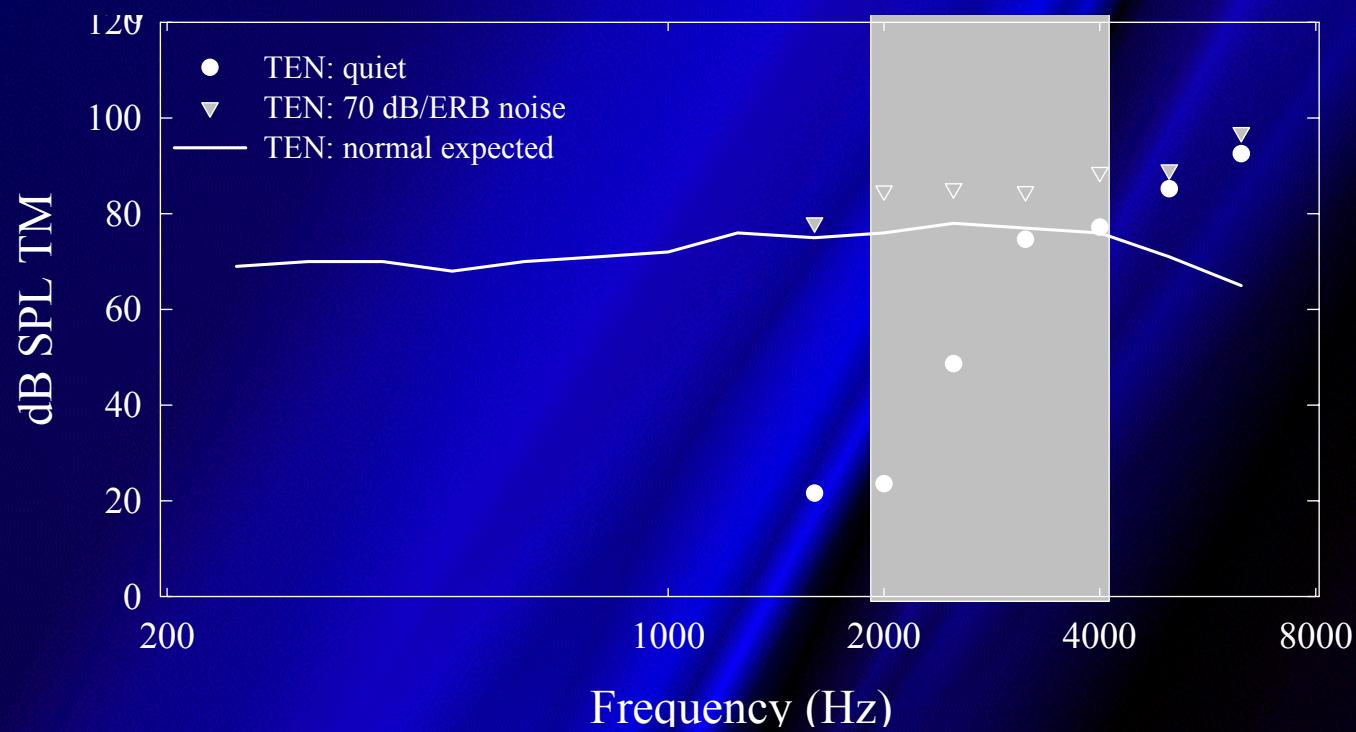
Arrows and shading indicate frequencies with significant threshold shifts



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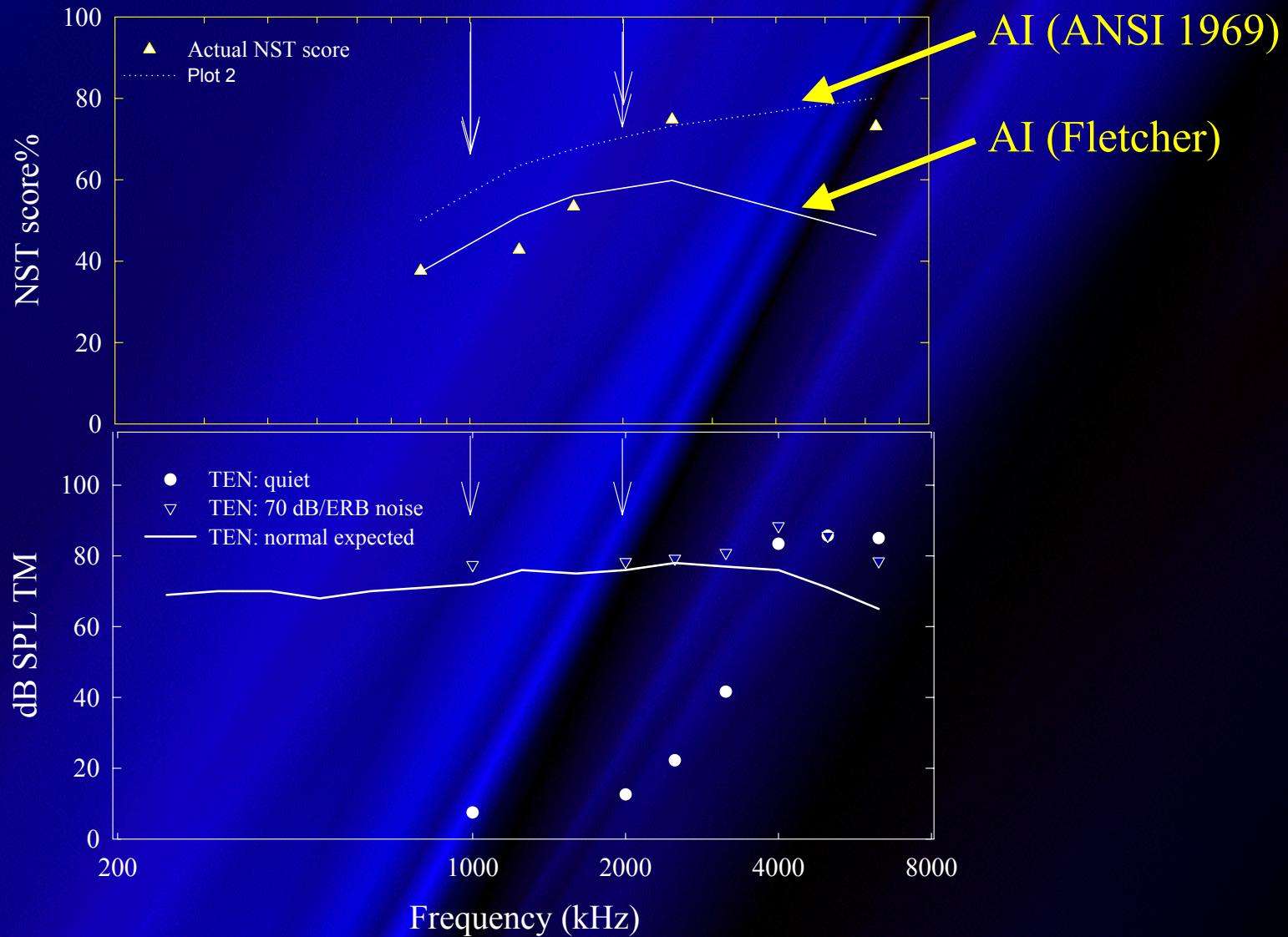
CD TEN Test Clinically Viable Today?

- Not in my opinion. Why?
 - Too time consuming – required to measure quiet thresholds twice.
 - Not sensitive enough – hard to find folks with “dead regions”.
 - Probably won’t change patient management...

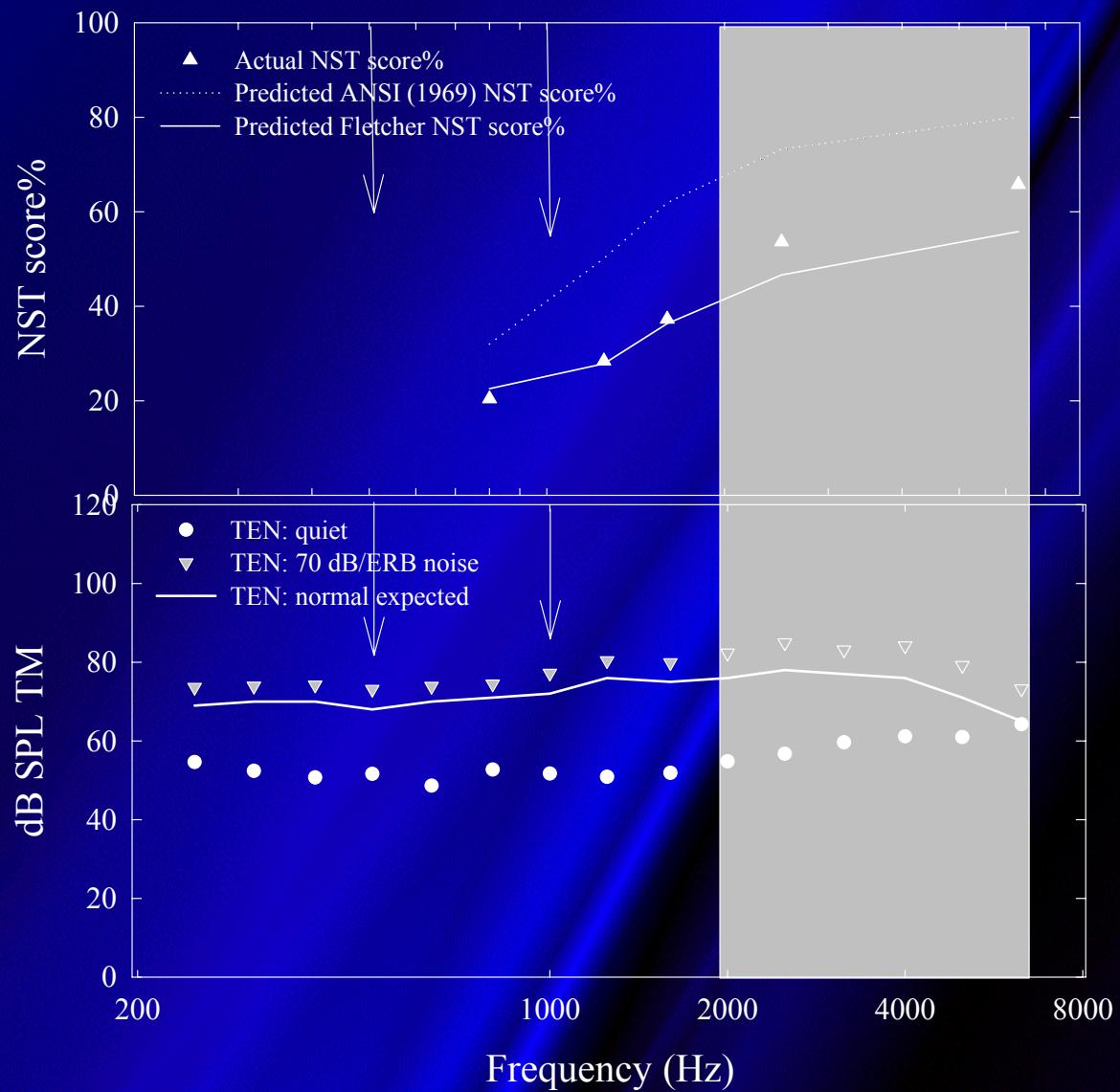
Correlation between “Dead Region” and Speech Recognition?

- Methods
 - TEN test with 3IFC procedure
 - Nonsense Speech Test (NST – UCLA recordings)
 - 5 low-pass cut-off frequencies
 - Selected to provide significant difference in expected performance if subject could make use of additional speech information – based on AI (1969)
 - 504 stimuli per condition

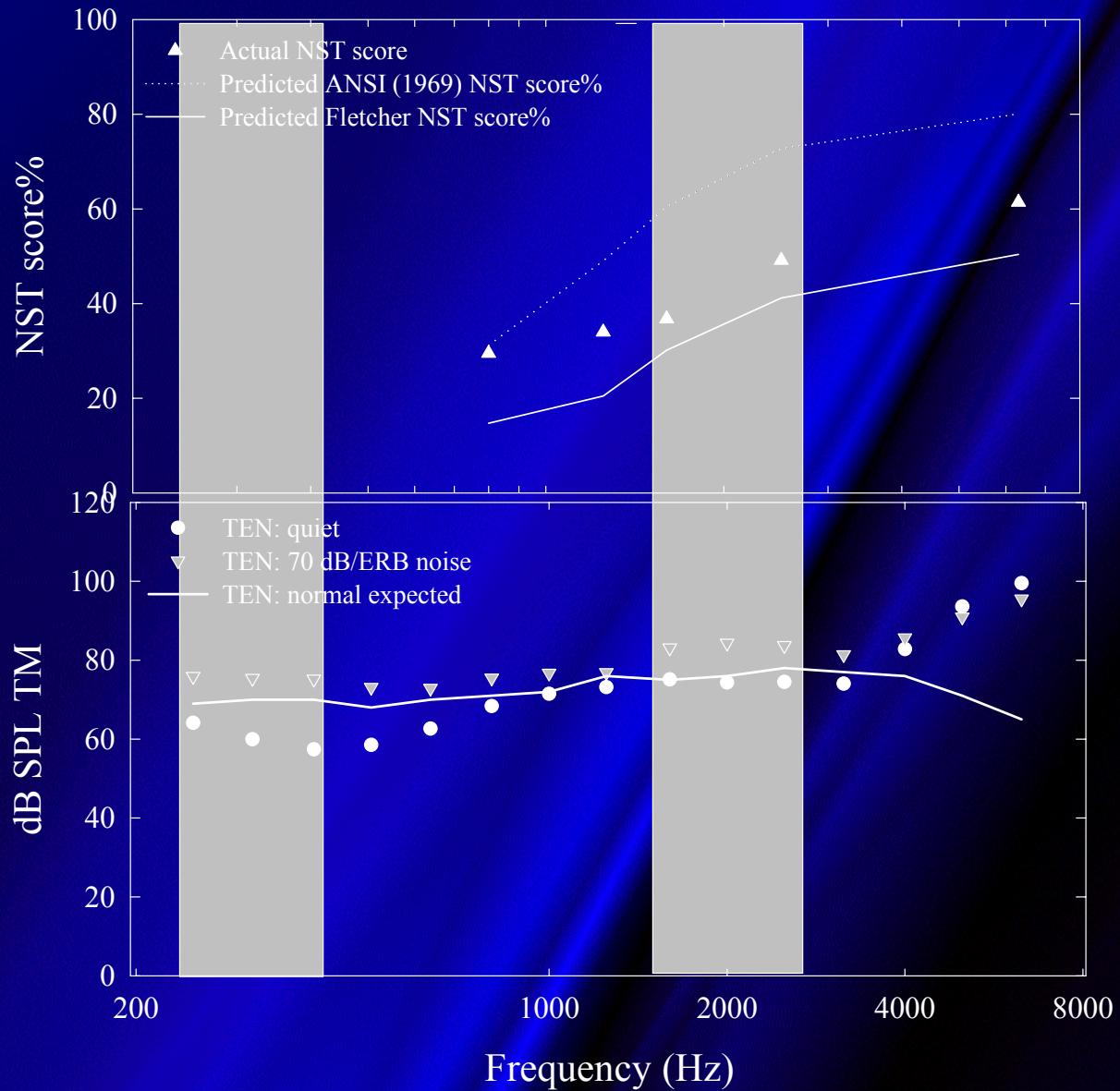
BF Right (NST and TEN data)



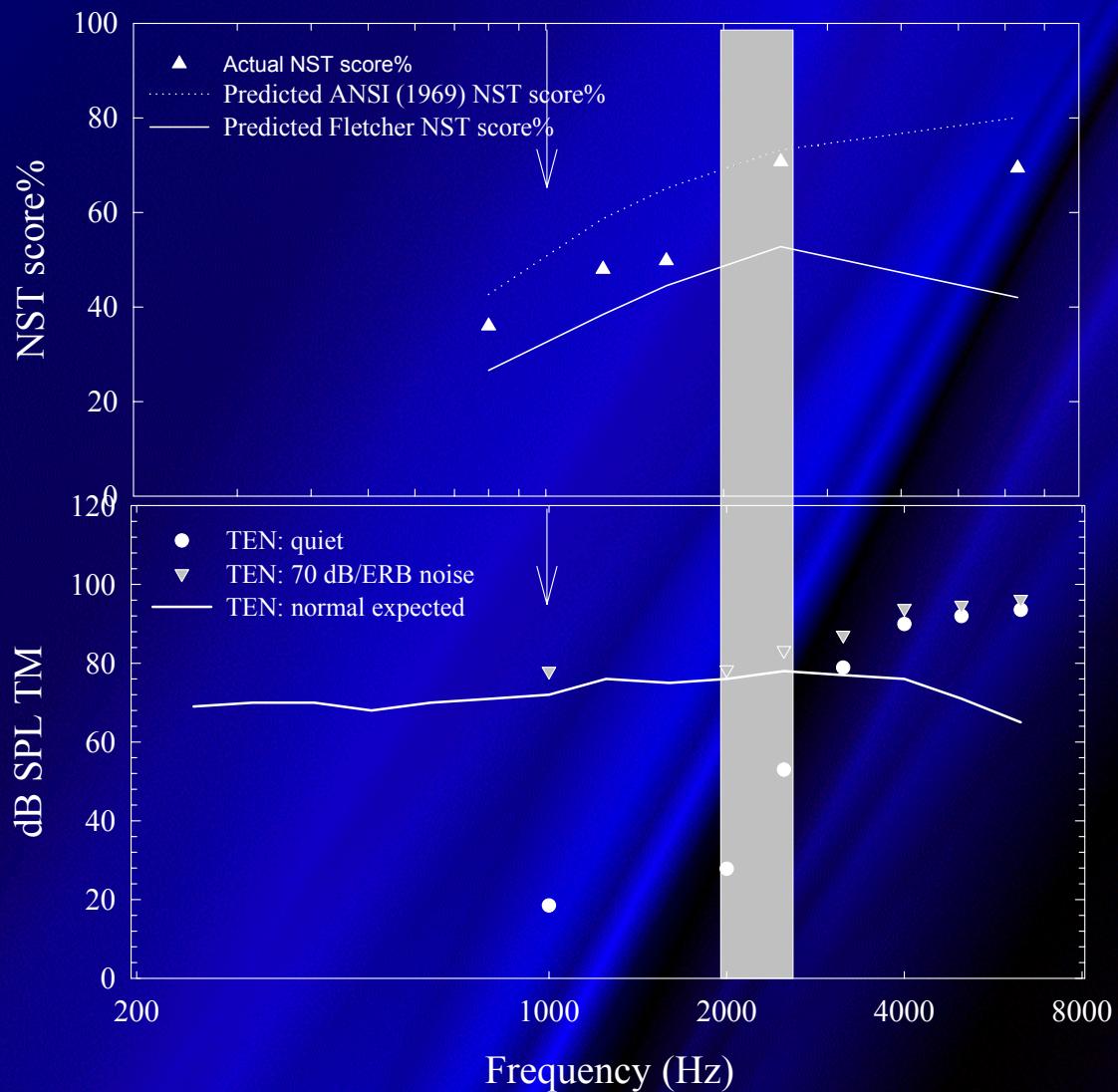
ER Left (NST and TEN data)



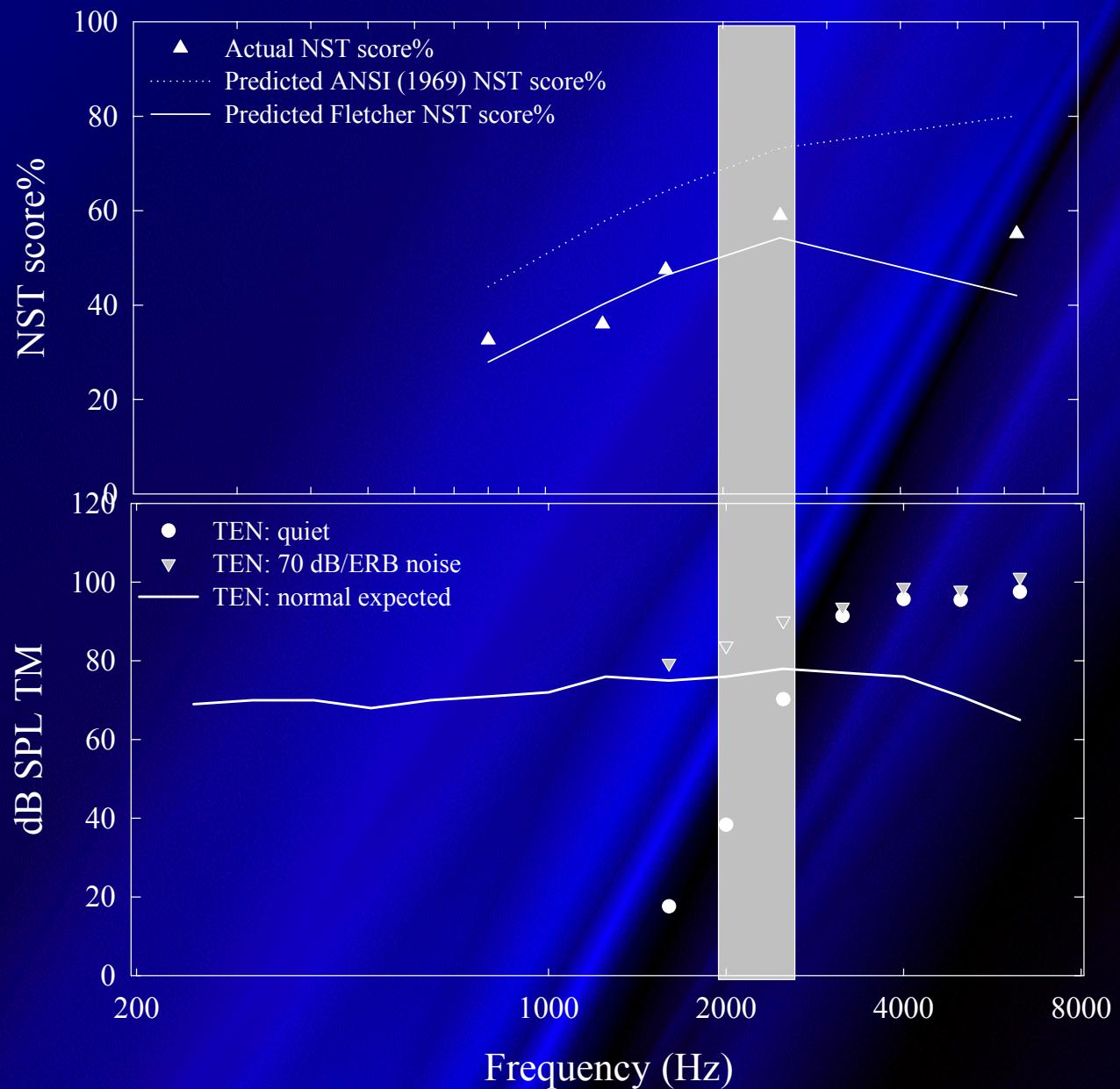
RW Right (NST and TEN data)



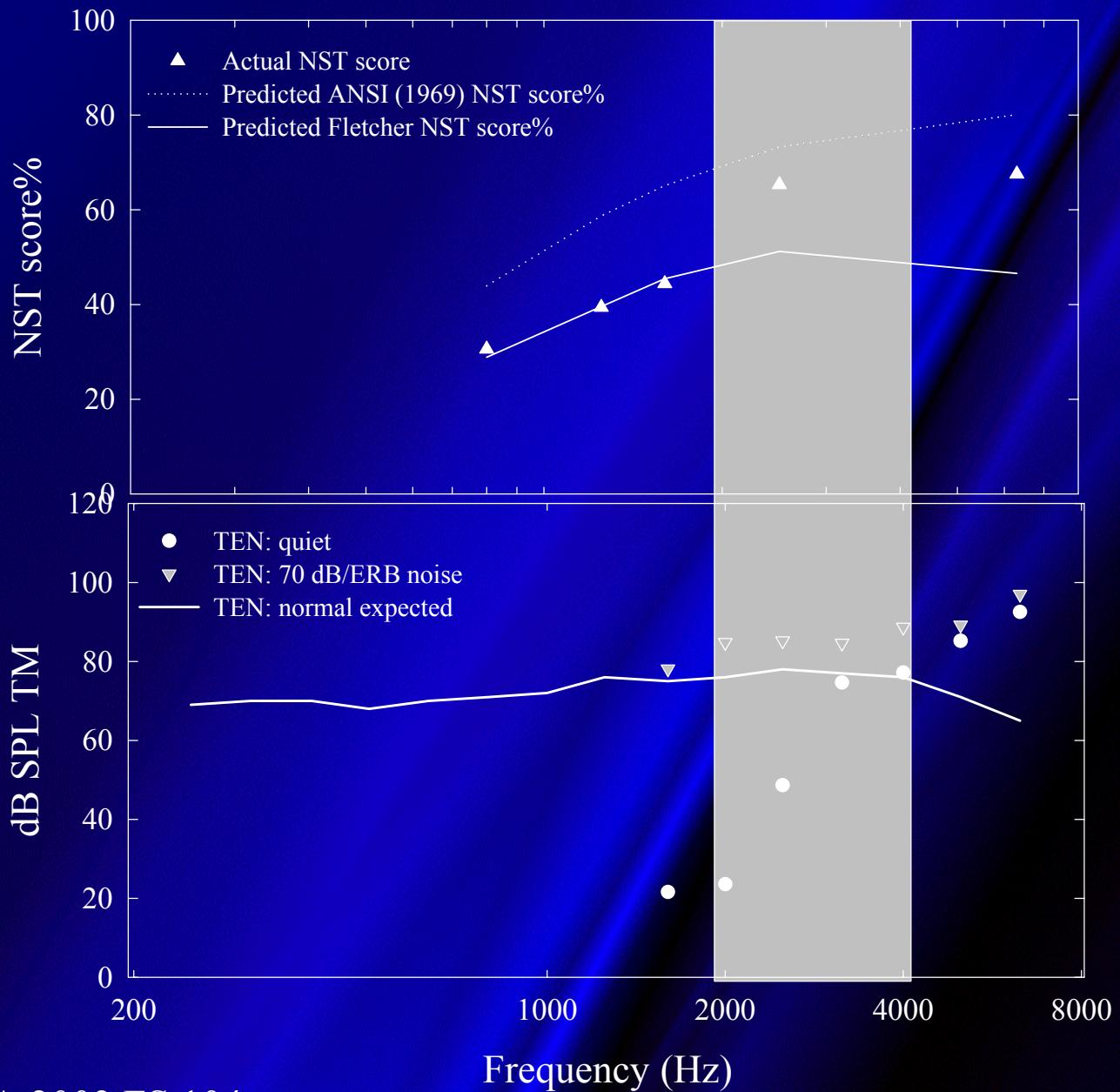
BF Left (NST and TEN data)



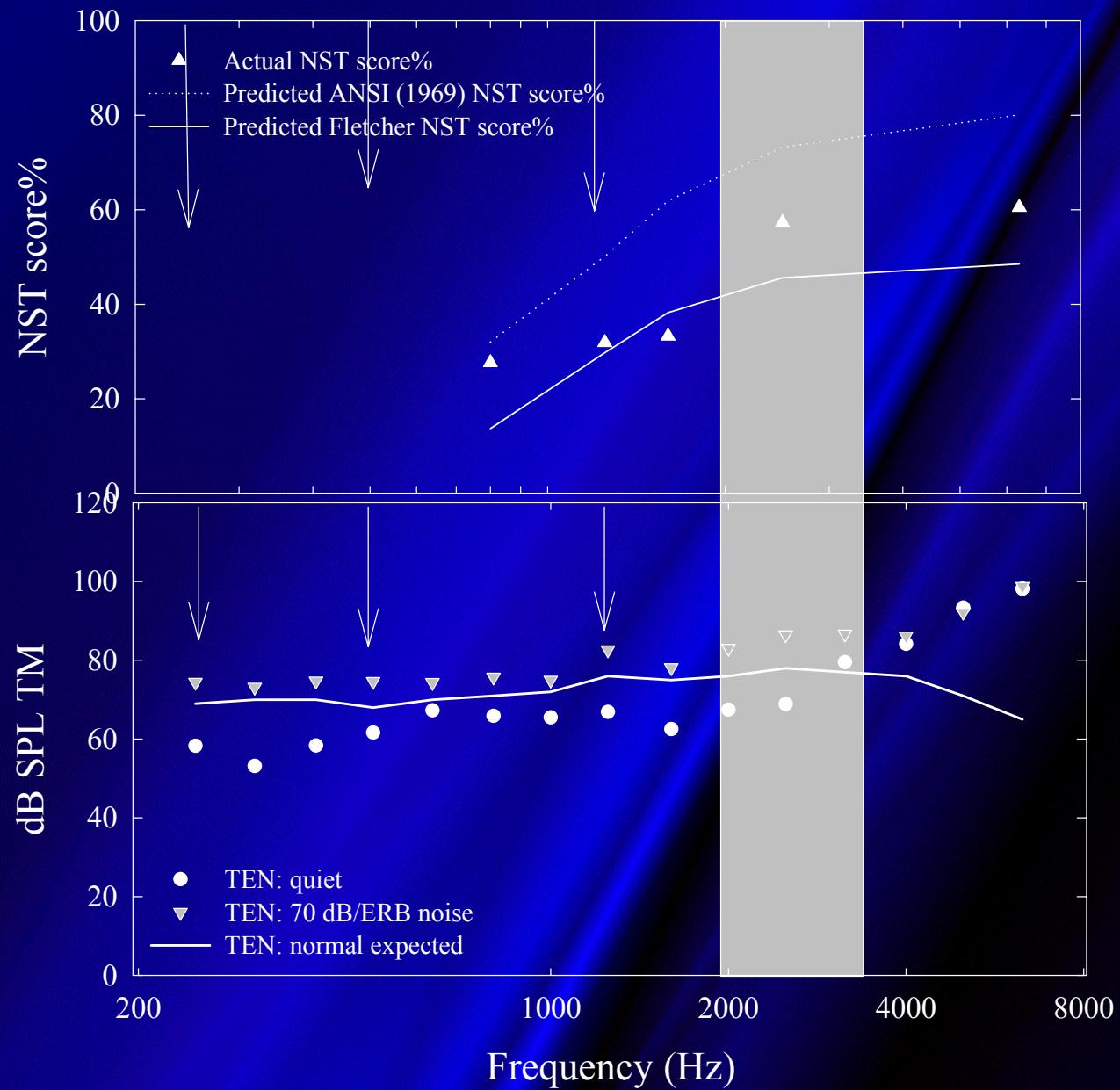
TA Left (NST and TEN data)



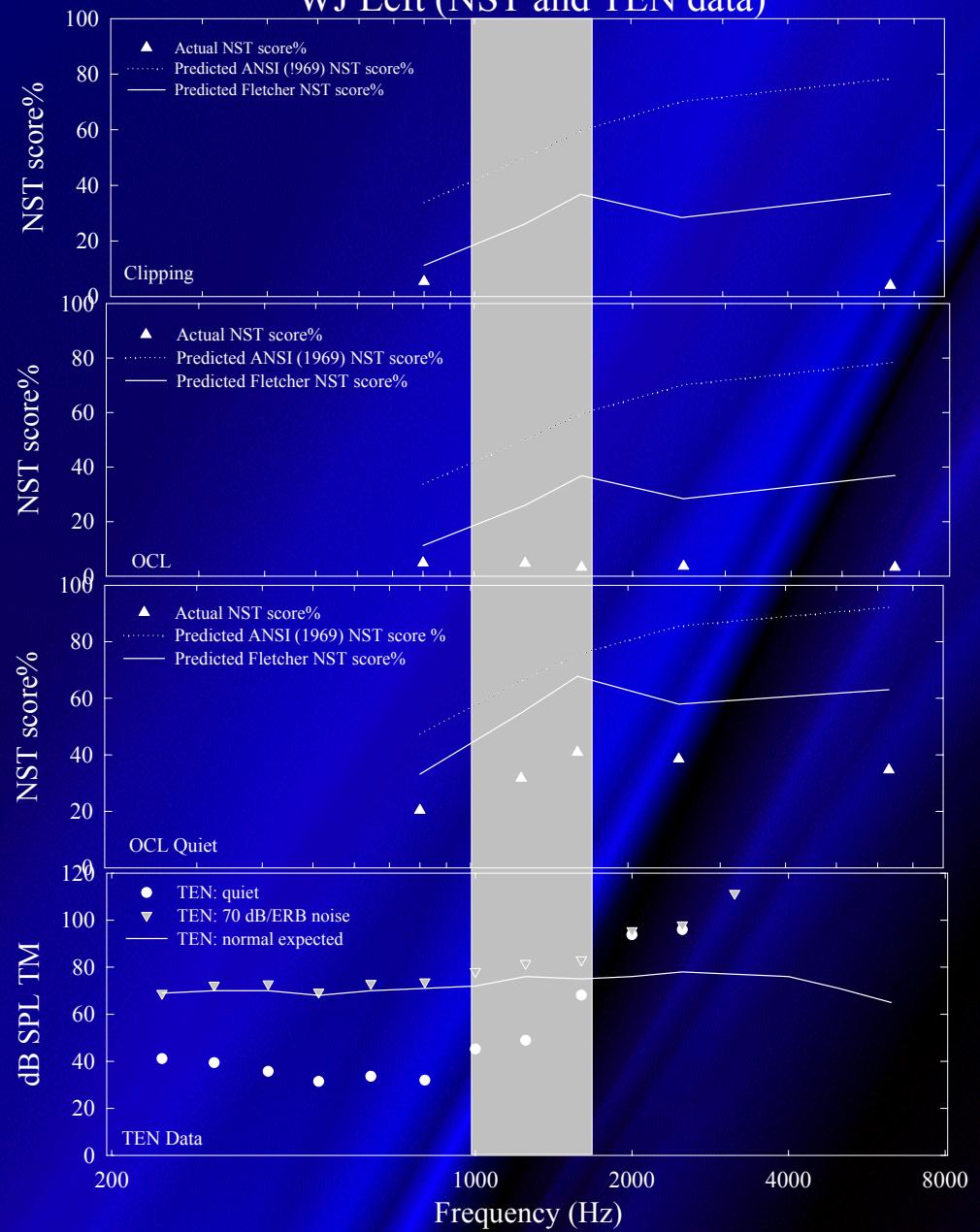
TA Right (NST and TEN data)



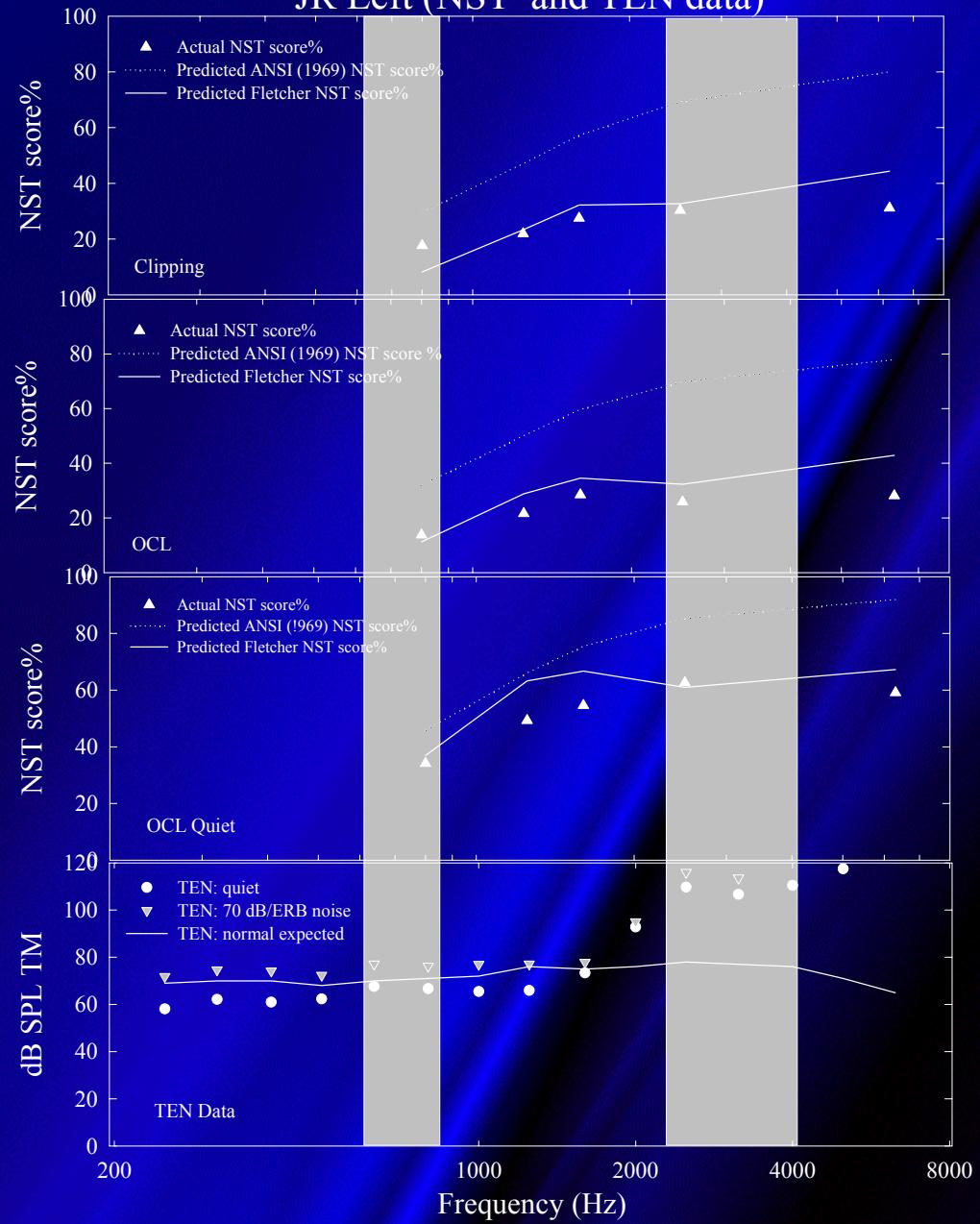
RW Left (NST and TEN data)

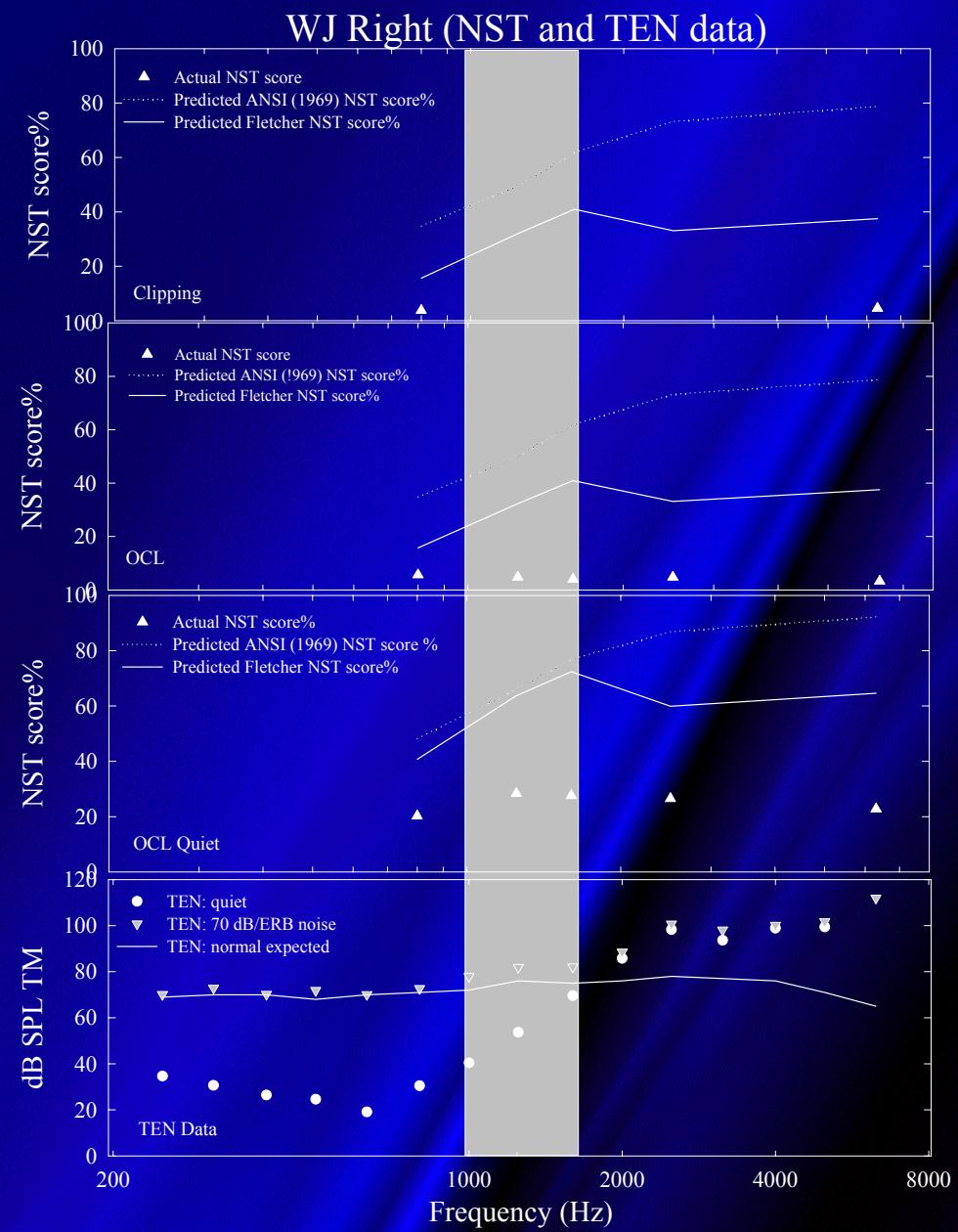


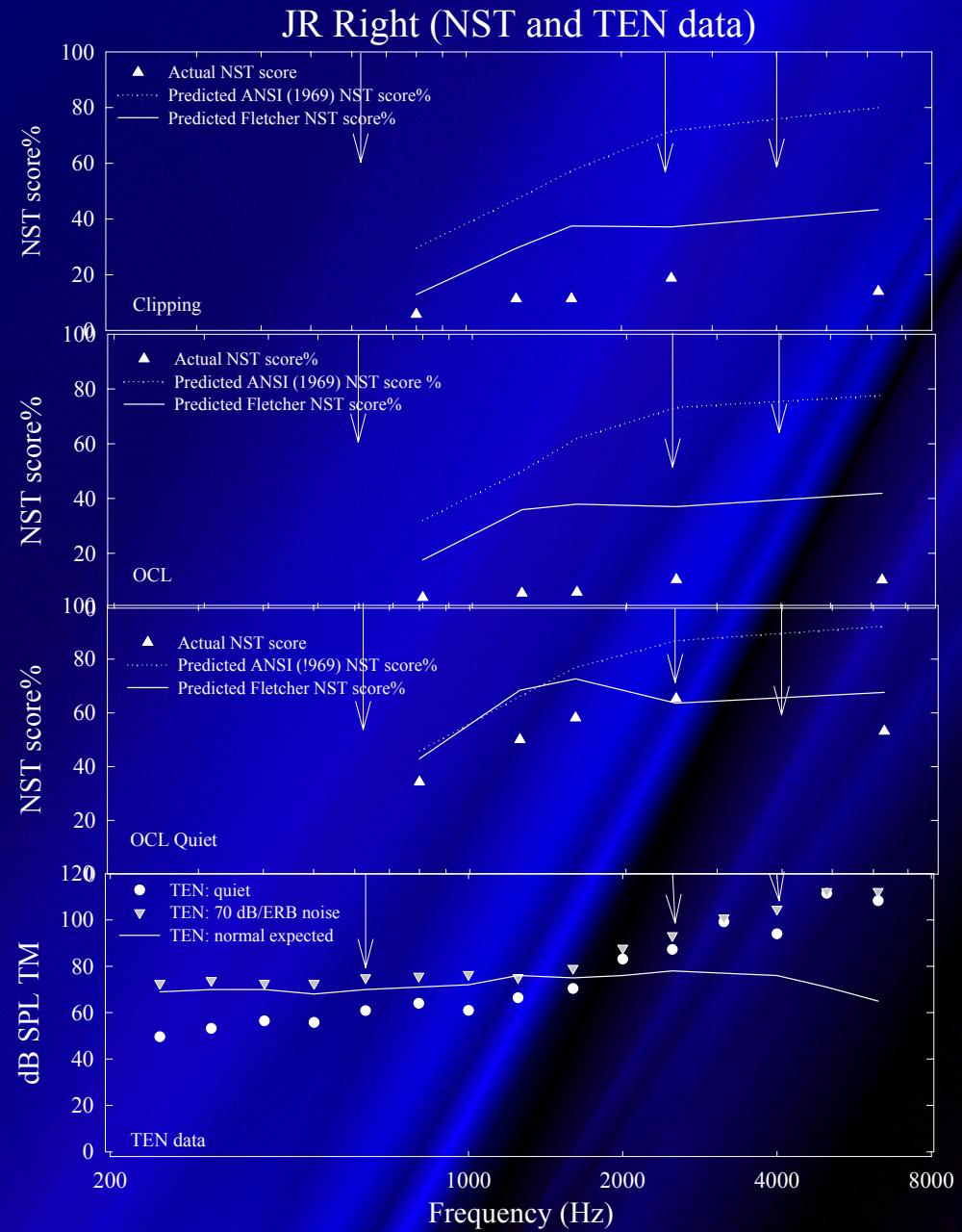
WJ Left (NST and TEN data)



JR Left (NST and TEN data)







Results

- Subjects can be categorized into 2 or 3 groups
 - 3 group categorization
 - Subjects' performance continued to increase in the “Dead Region”
 - Subjects' performance didn't improve (if you squint) in the “Dead Region”.
 - Subjects' performance was poor overall
 - 2 group categorization
 - performance well predicted by AI
 - Performance not well predicted by AI

Conclusions

- Results don't suggest that the test will add diagnostic value over audibility considerations alone.
- Reinforces the often over looked possibility of poor performance due to over amplification.
- Perhaps a simple modification in prescriptive targets based on AI would provide as much value.